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Studies on the *Mytilus edulis* Community in Alamitos Bay, California: I. Development and Destruction of the Community[1]

BY

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(5 Text figures)

INTRODUCTION

SCHEER (1945) STATED in his paper dealing with the development of marine fouling communities that it is important to distinguish between seasonal progression and true succession. He cited the work of MCDOUGALL (1943) at Beaufort, N. C. as an example of seasonal progression, and his work in Newport Bay, California, as true succession. He found experimental plates suspended during different times of the year went through the same sequence of development in forming the climax community of *Mytilus edulis* LINNAEUS, 1758.

The study of marine fouling organisms has attracted a considerable amount of attention throughout the world and especially along the Pacific Coast of North America. Much of the world data have been summarized in the U. S. Naval Institute publication on marine fouling (ANONYMOUS, 1952). Along the eastern Pacific Ocean studies have been conducted at Friday Harbor, Washington (JOHNSON & MILLER, 1935), San Francisco Bay (GRAHAM & GAY, 1945), Los Angeles - Long Beach Harbors (BARNARD, 1958; REISH, 1961 b), Newport Bay (SCHEER, 1945), La Jolla (COE & ALLEN, 1937; ALEEM, 1957), and San Diego Bay (WHEDON, 1937, 1943, in ANONYMOUS, 1952). In the majority of these studies, test panels were placed periodically in the sea in order to obtain data on the seasonal settlement of marine organisms. With the construction of a large boat harbor in Alamitos Bay in 1959, it was possible, in an area never before exposed to sea water, to determine whether or not the establishment of the *Mytilus edulis* community is a seasonal progression or a true succession.

MATERIALS AND METHODS

Alamitos Bay (Figure 1) is a small body of water located within the city of Long Beach, California, which is used primarily for recreational purposes. The details of the dredging and construction of the marina area of the bay have been described elsewhere (REISH, 1961 a, 1963).

In order to ascertain whether seasonal progression or true succession occurred, the study was conducted in two

[1] This study was supported by research grant NSF G-8914 from the National Science Foundation.

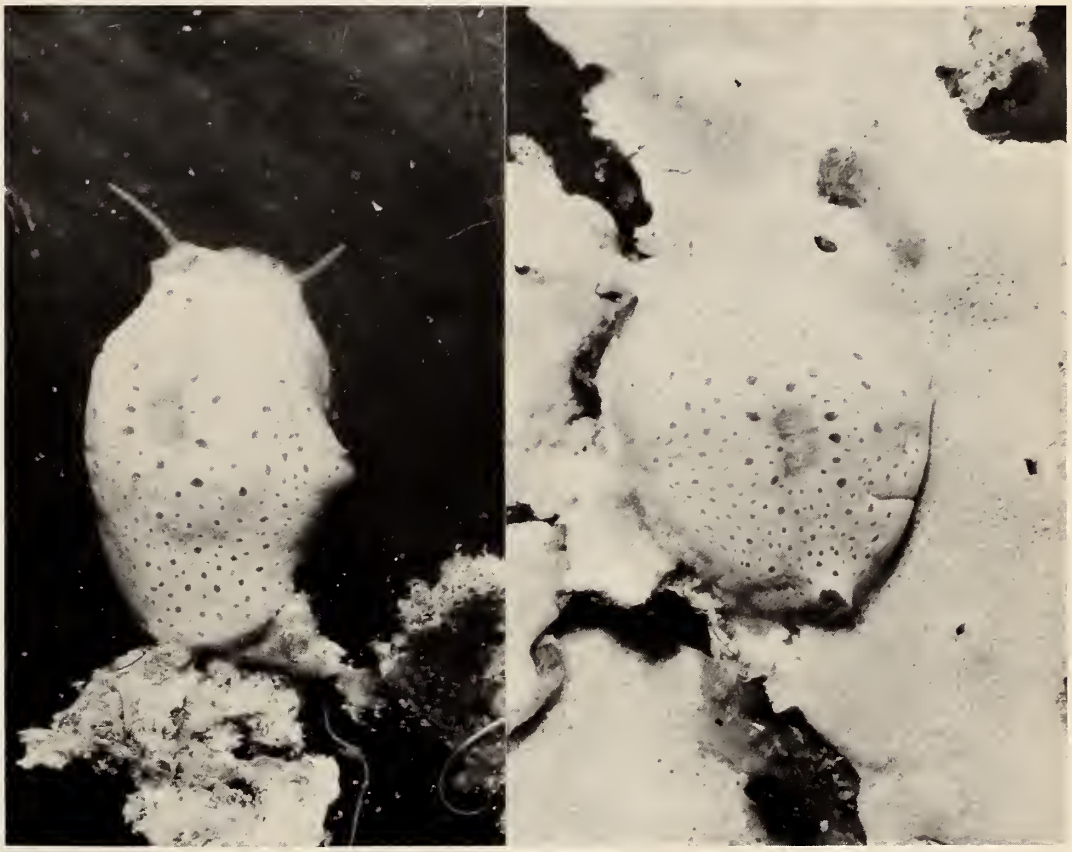

Figure 1 Figure 2

Figure 1: *Lamellaria stearnsii* crawling on the bottom of a dish.
Figure 2: *Lamellaria stearnsii* at rest on *Trididemnum opacum.*

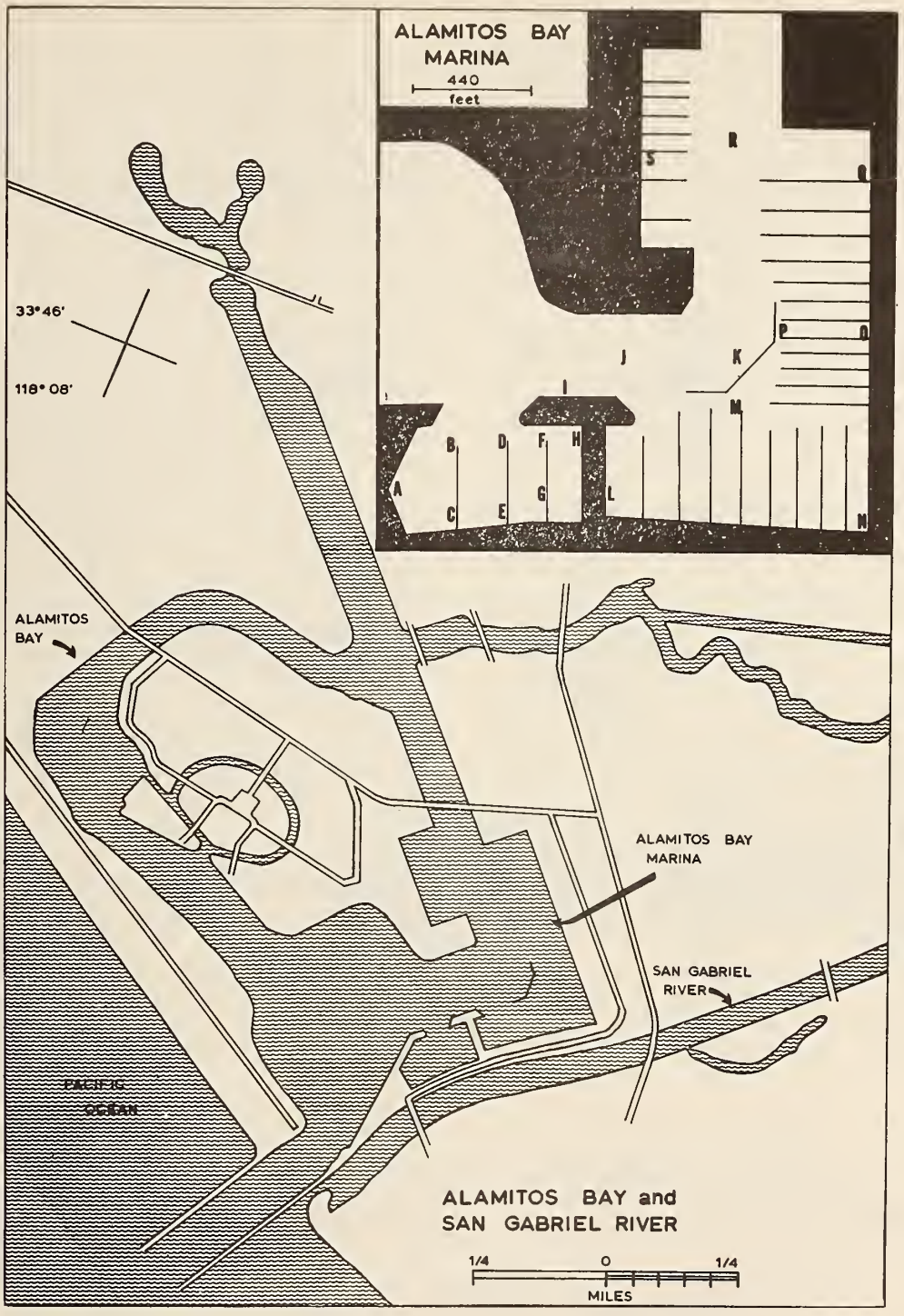

Figure 1: Map of Alamitos Bay, California. Collection site located at Station P (see inset map.)

ways: (1) collections were made monthly for three years from the sides of boat docks beginning two weeks after they were first placed in the water, and (2) scraping the sides and bottom of one different float free from all macroscopic organisms approximately each season of the year and then making bimonthly collections from the sides and bottom for the next 1.5 years.

The individual boat dock (Figure 2) is constructed of wooden decking which is buoyed by a reinforced molded fiber glass plastic pontoon. The docks are held in position by concrete pilings but are free to move up and down with the tides. Each pontoon is divided by constructions into eight sections with the two outer ones being slightly larger. The first collection made on October 21, 1959, was taken from the left section (Figure 2, Number 1), the following month from the adjacent section (Number 2), etc. Collections 7 to 12 were made from the adjacent pontoon at the next dock (a distance of about 5 meters); collections 13 to 18 from a third pontoon, etc. Thus, each successive collection had been exposed one month longer than the preceding one. The study was terminated October 19, 1962. The pontoons from which collections were made all had the same exposure (west) and were within a few meters of each other. Each section of the pontoon measured 13 by 25 cm giving a surface area of 325 cm^2.

In the second study the floats were scraped on March 3, July 12, September 28, 1961, and February 2, 1962. Collections were made bimonthly. This study was terminated August 15, 1962. Collections from the side of the floats were made in the same manner as described above. Samples of the bottom of the float covering the same surface area were made by an aqualung-diver.

The fouling organisms were preserved in formalin in the field and then sorted, identified, weighed, and measured in the laboratory.

The water temperatures were summarized from the daily readings taken of the ocean by the City of Long Beach. These figures compared with those obtained by the author within the marina.

ACKNOWLEDGMENTS

The author wishes to thank Dr. Donald P. Abbott and Dr. John D. Soule for identifying some of the tunicates and bryozoans, respectively, encountered in this study. The author wishes to thank also Miss Emilie Bender, Mrs. Bettye Byrne, Miss Janet Budnick, Miss JoAnn Loper, Miss Ruth Zakem and Mr. Harold Pope for sorting the organisms collected in this study.

DATA

Settlement of Principal Organisms.

The data on the settlement of the principal organisms are summarized in Figure 3. The initial inhabitant consisted of the bacterial-algal scum as reported by others (Scheer, 1945; Aleem, 1959). The ectoproct *Bugula neritina* (Linnaeus, 1758) was the first macroscopic organism to settle on the floats. It first settled about one month after the floats were submerged and reached its maximum development by November 1959. The tube-building polychaete *Hydroides norvegica* (Gunnerus, 1768) replaced *B. neritina* as the dominant organism by December 1959. A month later the green alga *Ulva lobata* (Kützing, 1849) Setchell & Gardner became the dominant organism, a position it maintained throughout the first half of 1960. The climax organism, *Mytilus edulis,* first appeared in February 1960, but it was not until June 1960, that its biomass exceeded that of *U. lobata.* This pelecypod dominated the community until the entire association was affected by the red tide outbreak in the fall of 1962.

Growth of the Principal Organisms.

Following its initial dominance, *Bugula neritina* was taken frequently, but never abundantly, except during July and August 1962. The settlement of this species always occurred when the water temperature was between 15.6° and 19.4° C. *Bugula neritina* was not taken in November 1960 nor in December 1961, when the water temperatures were within this range. Elsewhere (Anon-

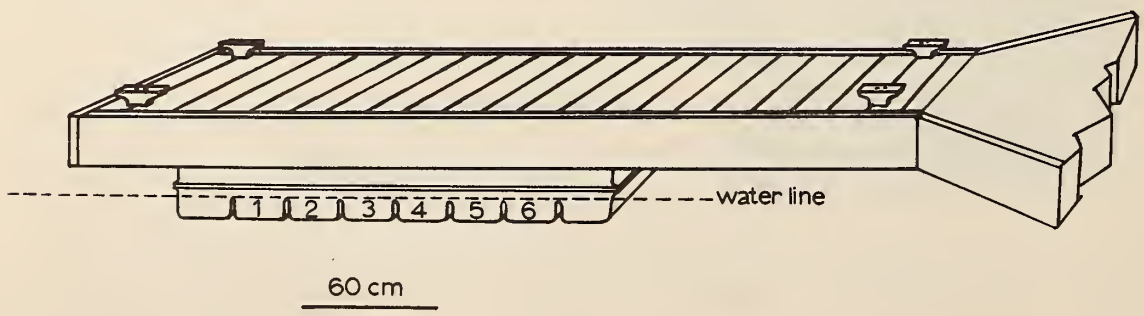

Figure 2: Diagram of boat dock and float. Numbers indicate site and order of collection.

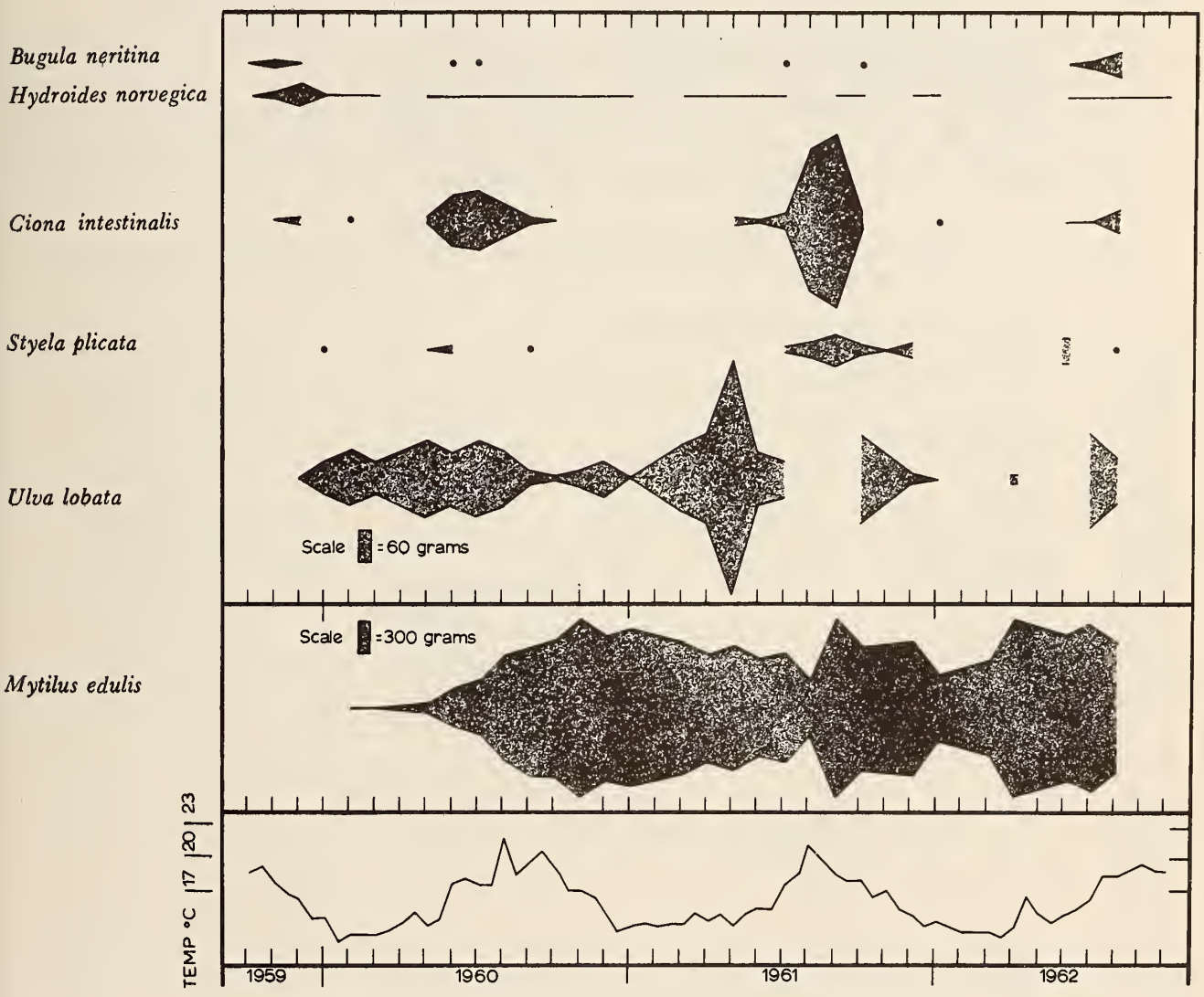

Figure 3: Diagramatic representation of the appearance a nd growth in biomass of the principal organisms of the *Mytilus edulis* community. Temperature data from the re cords of the City of Long Beach, California.

YMOUS, 1952) it has been found to attach when the water temperature ranged from 15° to 18° C.

Hydroides norvegica was present on the floats most of the time throughout the three year period. The population peak occurred during November and December 1959 when the water temperature ranged from 16.7° to 18.9° C. In nearby Los Angeles Harbor heavy settlement of *H. norvegica* was noted when the water temperatures were above 18.4° C; however, the volume of the polychaete tube growth in Alamitos Bay never approached the quantity observed in Los Angeles Harbor. Growth of the polychaete, as measured by tube length, increasd from 5 to 8 mm in October 1959 to 10 to 22 mm in December 1959. This is far short of the 100 to 150 mm lengths observed on the hulls of ships by WISELY (1958).

The population of *Ulva lobata,* as measured by weight, fluctuated considerably after its development in spring 1960. The fluctuations are apparently correlated with optimal temperature ranges between 13° and 18.5° C, giving a spring and fall peak in growth.

The changes in the population of *Mytilus edulis* are represented by weight (Figures 3 and 4) and by the number of individuals present (Figure 4). The first few specimens appeared on the floats in February 1960, with additional ones attaching during the spring months. Following the peak of 352 specimens in June 1960, the

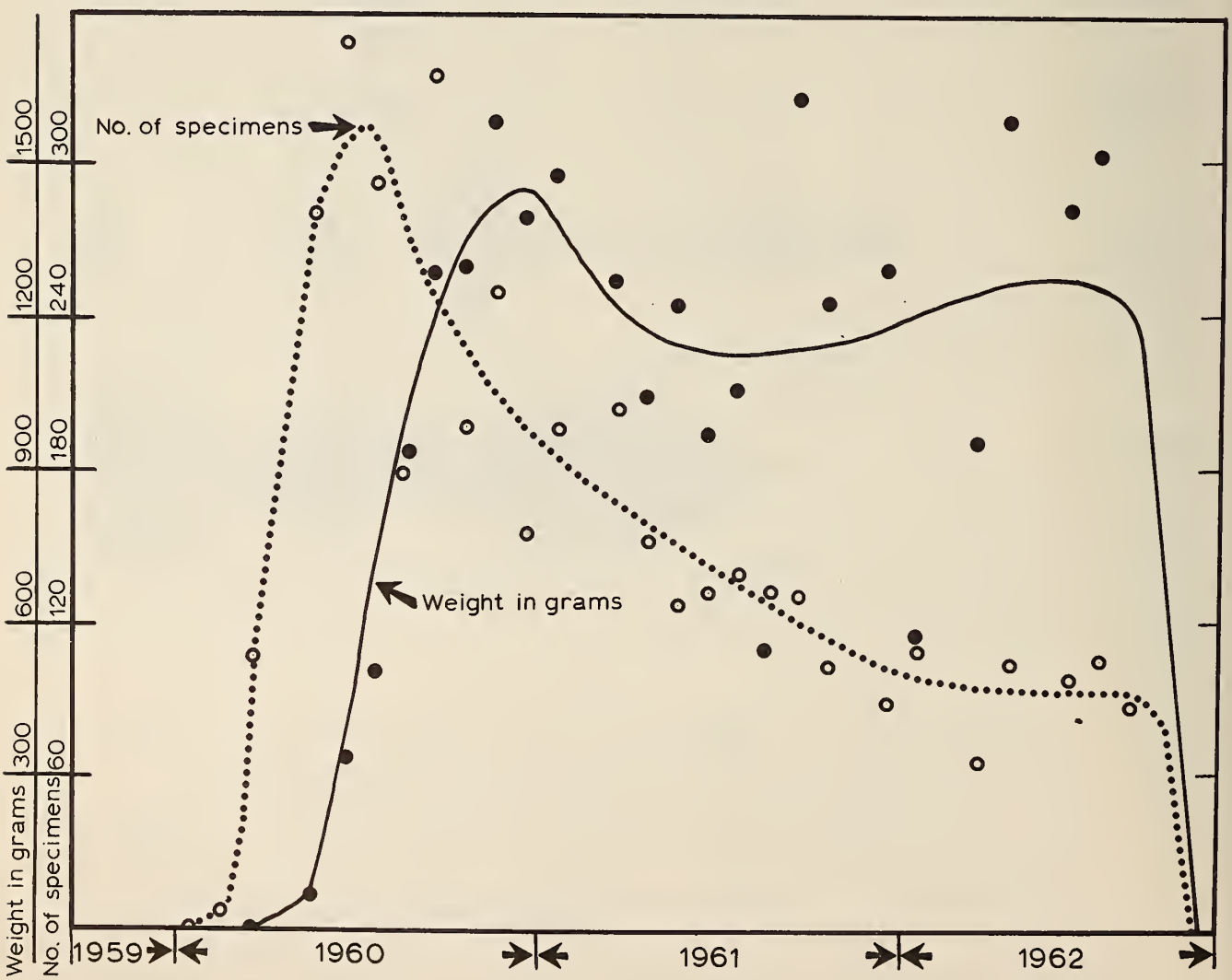

Figure 4: Graph showing the settlement, growth rate, and destruction of the *Mytilus edulis* community.

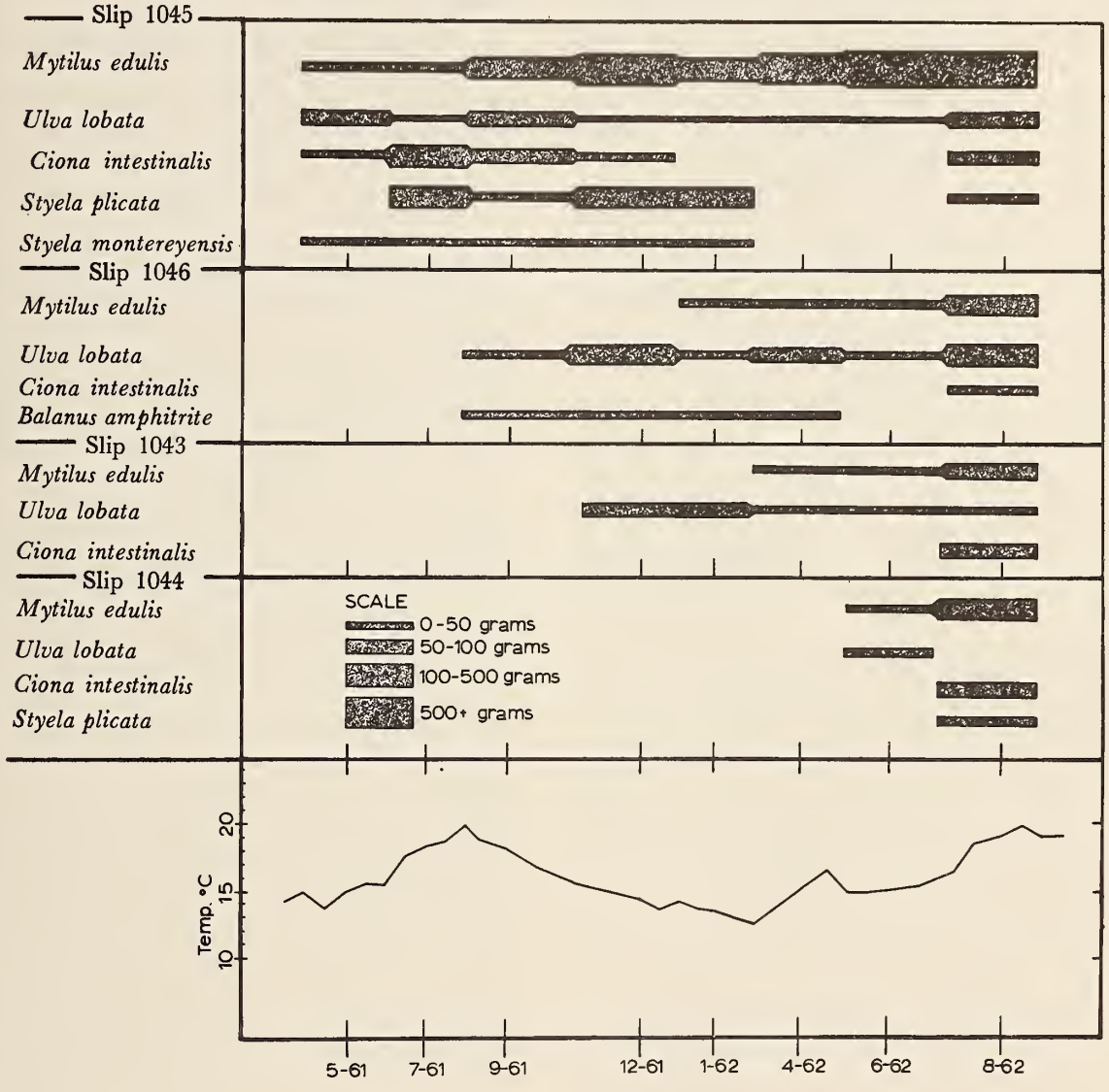

Figure 5: Diagramatic representation of the appearance and growth in biomass of the principal organisms settling on floats scraped seasonally. Slip 1045 scraped March 3, 1961; slip 1046 on July 12, 1961; slip 1043 on September 28, 1961; slip 1044 on February 2, 1962. Dates at bottom of chart indicate time of collection. Temperature data as in Figure 3.